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DIOPHANTINE ANALYSIS.

132. Proposed by DR. OSWALD VEBLEN, Princeton University, Princeton, N. J.

From the numbers, 0, 1, 2, ..., 42, select seven, such that the 42 differences of these seven numbers shall be congruent (mod. 43) to the numbers 0, 1, 2, ..., 42. The differences may be both + and -.

133. Proposed by R. D. CARMICHAEL, Hartselle, Alabama.

Find all perfect numbers of four primes and of multiplicity 4.

GROUP THEORY.

14. Proposed by O. E. GLENN, Springfield, Mo.

Hölder has proved* that any group (G) of order $\sum_{i=1}^n p_i$ (p_i a prime $\neq p_j$) may be generated as follows: $M^\mu = N^\nu = 1$, $N^{-1}MN = M^a$, where $\{M\}$ is the product of all the invariant subgroups of G of prime order and $\{N\}$ is any one of a set of conjugate cyclical subgroups of order ν , ($\sum_{i=1}^n p_i = \mu\nu$). Find the generating relations of G in terms of operations of prime order, and express M and N in terms of these operations, for $n=4$.

MECHANICS.

187. Proposed by M. E. GRABER, A. M., Heidelberg University, Tiffin, Ohio.

Find the path described by a particle acted upon by a central force, the force being directly proportional to the distance of the particle.

188. Proposed by H. L. ORCHARD, M. A., B. Sc. (Unsolved problem in the Educational Times, London.)

Spherical bubbles are rising in water. Find the relation between radius and velocity.

UNSOLVED PROBLEMS.

NOTE. The following problems still remain unsolved (in our columns).

Calculus, 209. Proposed by J. EDWARD SANDERS, Reinersville, Ohio.

A thread makes n ($=30$) equidistant spiral turns around a rough cone whose altitude is h ($=10$ feet), and radius of base r ($=11$ inches). How far will a bird fly in unwinding the thread if the part unwound is at all times perpendicular to the axis of the cone?

Calculus, 212. Proposed by O. E. GLENN, Ph. D., Springfield, Mo.

Show that any root of the equation $y^5 - 5y = 4x$ satisfies the differential equation $\frac{d^4 y}{dx^4} = (\frac{4}{5})^4 x^{-\frac{8}{5}} \frac{d^4 (x^{-\frac{1}{5}} y)}{d(x^{-\frac{1}{5}})^4}$. Generalize the problem.

*See Burnside, *Theory of Groups*, p. 353.